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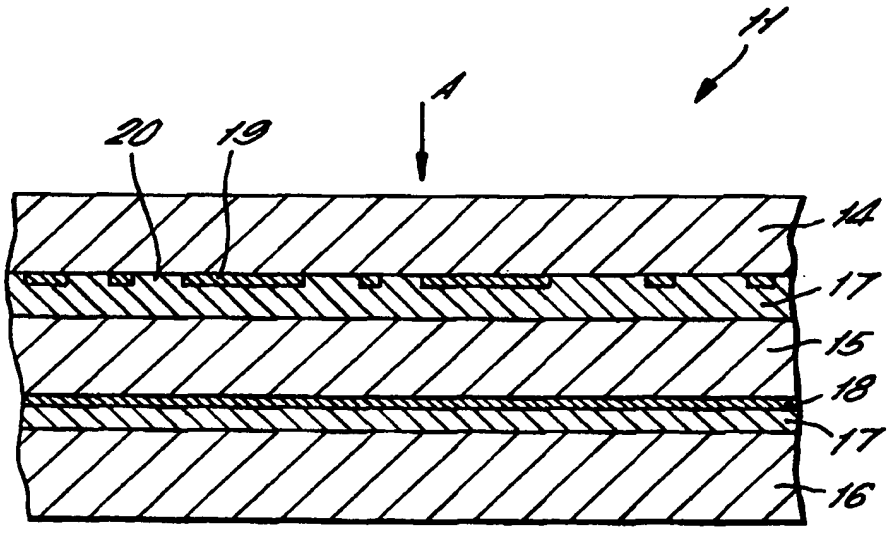

(57) Abstract

The invention relates to improved security documents such as banknotes, cheques and passports which are required to provide a high degree of security against imitation and a substrate for producing such security documents. A substrate for security documents and the like according to the invention comprises a first layer (16) of biaxially oriented polymeric film laminated together with a second layer (15) of biaxially oriented polymeric film with a metallic layer (18) between, and a third layer (14) of biaxially oriented polymeric film laminated to the second layer with a partially metallised metallic layer (19) therebetween, the metal in each metallic layer being the same or visually similar.

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IMPROVEMENTS IN SECURITY DOCUMENTS AND SUBSTRATES THEREFOR

The invention relates to improved security documents such as banknotes, cheques and passports which are required to provide a high degree of security against imitation and a substrate for producing such security documents.

Such documents are traditionally made from security paper, that is paper having good durability and a high resistance to crumpling and tearing. However, such documents are still prone to damage through water, cutting and eventual wear. Furthermore such security documents are vulnerable to forgery.

To prevent counterfeiting it is widely known to use in traditional banknotes and security documents, security devices such as security threads or strips which are made from a transparent polyester film provided with a wholly or partially reflective metallised layer. The threads are wholly or partially embedded within the paper and provide a high degree of security against counterfeiting. However, the paper itself is still subject to a degree of wear and damage.

This problem has been addressed in International Patent Application WO83/00659 which describes a plastic banknote. This banknote is made up from one or more films of transparent biaxially oriented polymers which are coated with layers of relatively opaque printing ink and heat activated adhesive material. An optically variable security device such as a diffraction grating is adhered to the substrate in a window left in the opaque layer. The substrate is then printed with identifying indicia and covered on both sides by further layers of polymer material. Most counterfeiters do not have access to equipment for making such materials and plastic banknotes are

damage and wear resistant. It should be noted that whilst biaxially oriented polymer films such as those described in WO83/00659 have excellent resistance to tear initiation (i.e. edge tear resistance) they have poor resistance to tear propagation (i.e. internal tear resistance) when compared to paper.

It is an object of the present invention to provide improved security documents and substrates therefor made from a polymeric material to address the problems of counterfeitability.

It is a further object of the present invention to provide a security feature in the form of a hidden message which becomes visible under appropriate viewing conditions.

According to the invention there is therefore provided a substrate for security documents comprising a first layer of biaxially oriented polymeric film laminated together with a second layer of biaxially oriented polymeric film with a metallic layer between, and a third layer of biaxially oriented polymeric film laminated to the second layer with a partially metallised metallic layer therebetween, the metal in each metallic layer being the same or visually similar.

Preferably there are a plurality of partially metallised metallic layers, each of which is located between a pair of polymeric layers.

At least one metallic layer may provide an electrically conductive path along the width or length of the substrate.

A magnetic material may be provided between two metallic layers.

A layer of polarising material is preferably provided on one or both external surfaces of the substrate.

Preferably the substrate further comprises a dichroic coating on one or both external surfaces of

the substrate.

Preferably the thicknesses of at least two of the polymeric layers are different.

The metallic layers may only be present in a limited region of the substrate.

The invention also provides a security document produced from the substrate.

A security document may incorporate a limited region produced from the substrate.

The invention also provides a security element produced from the substrate.

A security document preferably incorporates such a security element, which element is exposed at intervals in windows.

The invention will now be illustrated by the following examples with reference to the accompanying drawing, in which Fig. 1 is a longitudinal cross-sectional side elevation of a substrate for a security document according to the present invention.

The substrate comprises a laminate of at least three biaxially oriented polymeric layers laminated together with partial or whole layers of metal sandwiched between the polymeric layers.

Example 1

As shown in Fig. 1, the substrate 11 comprises three polymeric layers 14, 15, 16, laminated together with layers of adhesive 17. Layers 14 and 15 are transparent films which have been metallised. Layer 15 has a whole layer of metal 18, whilst the metal layer on layer 14 has been selectively metallised or demetallised to have regions of opaque metal 19 and clear regions 20 forming embedded indicia. The embedded indicia may be of a positive nature, i.e. the indicia are formed by the metallic regions 19, or negative in which the indicia are formed by the clear regions 20. The indicia may be in the form of an

image, alphanumeric text, a pattern, or any other appropriate form.

The metal of the metallised films 14, 15 is preferably a vacuum deposited aluminium film, although another metal such as cobalt or sputtered nickel/iron may be used. The metallised film 14, 15 may be an SHM (™)film from Hoechst Trespaphan which is available in various thicknesses. The layer 15 can then be selectively demetallised by a known process. Alternatively the layer 15 can be a transparent film, which is not metallised, such as GND (™) film also from Hoechst Trespaphan which is also available in various thicknesses. This can then be selectively metallised by a known process. Layer 16 is also a transparent film which is not metallised.

It should be noted that all references in this specification to a partially metallised layer should include a layer which has been created by a selective demetallisation process.

The layers 14, 15, 16 are laminated together, preferably with layers 17 of cross-linking or thermally activated adhesive with the metallic layers 18, 19/20 located between the transparent layers 14, 15, 16 so that they are wholly encapsulated within the substrate 11. As an alternative to lamination using an adhesive, the polymeric films selected may be co-extruded multilayer thermoplastic films, of the type used in heat sealable packaging films, which may be laminated together when thermally activated.

The metals used in the different layers must be the same or visually similar so that in ordinary light there is no visual distinction between the partially demetallised layer 19/20 and the fully metallised layer 15/18, and a single metallic colour is seen. Thus the indicia are, under such conditions, hidden.

However, the polymeric films described above exhibit interesting birefringence characteristics,

with birefringence colours being dependent on the refractive index, orientation, degree of orientation and thickness of the film. When viewed between a pair of polarising filters, either crossed or parallel, some such biaxially orientated polymeric films will provide birefringent colours. Where such a film is placed over a reflective metallic layer, the oriented film provides birefringent colours when viewed through only one polarising filter. Thus in the present invention, when the substrate 11 is viewed with a single suitable polarising filter such birefringent characteristics are exhibited which reveals the hitherto hidden indicia, which provides a useful security measure. The birefringent colours change according to the thickness of the film, so can be varied by laminating different numbers and/or thicknesses of polymeric layers together. Thus if, in the example illustrated in Figure 1, the polymeric layers 14, 15, 16 have respective thicknesses of 20 microns each, a different birefringent colour will be seen, when the substrate 11 is viewed from the direction of arrow A through a polarising filter, in the metal regions 19 covered by one polymeric layer 14 from that seen in the demetallised regions 20, through which the full metal layer 18 can be seen covered by two polymeric layers. In other words, the hidden indicia are revealed in the form of different colours.

Furthermore, when the angle of view is varied, a colour shift is observed due to the change in light path length through the film. This colour shift has the advantage that the observed colours in the direction of the major orientation are different to those in the perpendicular direction. For example a structure having 40 microns of biaxially oriented polypropylene over a metallised layer exhibits a purple colour when overlaid with a polarising filter and viewed close to normal. At increasing angles of

view (i.e. angle measured from normal) the colour changes through blue/green to a greyish colour when the observer moves in the long direction and from purple through yellow/green to blue, when the observer moves in the cross direction. This colour shift is especially effective when both of the two colours of the metallised regions 19 and the metal layer 18 exhibit different colour shifts.

For the demetallisation process, any suitable methods may be used, such as direct etching or indirect etching using a resist.

Alternatively a selective metallisation process may be used or the metal regions 18, 19 may be created by printing with a high reflectivity metallic ink.

Another alternative to making the substrate 11 would be to laminate transparent polymeric layers 14, 15, 16 with one fully and one pre-imaged metal foil layer therebetween. A further alternative would be to image the metallic layer by laser cutting or ablation of the metal either as an intermediate step in the construction of the substrate, or subsequent to its assembly. This would be particularly useful for metal other than aluminium, e.g. stainless steel.

Example 2

In this example a number of different partially metallised polymeric layers could be laminated together with the fully metallised layer, all the partially metallised layers bearing different metallic patterns of the same metal so as to create a multiple colour effect when viewed through the polarising filter, or with partially metallised layers on both faces of the continuous metal layer.

In all of the aforementioned examples, where there is a continuous metal path either along the length or width of the substrate, this provides an electrically conductive path which can be used for

authentication using appropriate machine readers.

In some applications, it may be advantageous for the metallic layer or layers to be partially or wholly obscured as in the following example 6 to 9.

Example 3

Any of the aforementioned examples may be modified by overprinting with a translucent coloured ink to give a coloured metallic effect. The translucent coloured ink may be applied directly to one or more of the metal layer or layers 18, 19 before the polymeric layers 14, 15 are laminated together.

Example 4

In this example, an opaque coating is applied to one or both of the external surfaces of the substrate 11 leaving one or more areas uncoated which form windows in which the birefringence colour effect of the metallised layers or regions 18, 19 can be viewed through the filter.

Example 5

The birefringent colours described in the previous examples can be made permanently visible by laminating to one or both sides of the substrate 11 a layer of an appropriate polarising material or using dichroic materials as external coatings for the substrates.

Example 6

In this example the metallised layers 18, 19 with or without additional metallic layers as suggested in Example 2, are only present in a limited region of the substrate 11. This may be a discrete element or a limited area running along the width or length of the note, as required. The rest of the substrate would be clear and comprised of just the layers of biaxially

oriented polymeric films 14, 15 and or others.

The substrate described above can be used to make all forms of security documents such as banknotes, cheques, and passports.

The substrate described herein may also be fixed to form security elements for partially embedding into security paper so that it is revealed at intervals in windows.

CLAIMS:

1. A substrate (11) for security documents and the like comprising a first layer of biaxially oriented polymeric film laminated together with a second layer (15) of biaxially oriented polymeric film with a metallic layer (18) between, and a third layer (16) of biaxially oriented polymeric film laminated to the second layer with a partially metallised metallic layer (19/20) therebetween, the metal in each metallic layer being the same or visually similar.

2. A substrate (11) as claimed in claim 1, further comprising a plurality of partially metallised metallic layers (19/20), each of which is located between a pair of polymeric layers (14,15,16).

3. A substrate (11) as claimed in claim 1, in which at least one metallic layer (18) provides an electrically conductive path along the width or length of the substrate (11).

4. A substrate (11) as claimed in any one of the preceding claims further comprising a magnetic material between two metallic layers (18/19/20).

5. A substrate (11) as claimed in any one of the preceding claims further comprising a layer of polarising material on one or both external surfaces of the substrate (11).

6. A substrate (11) as claimed in any one of the preceding claims further comprising a dichroic coating on one or both external surfaces of the substrate (11).

7. A substrate (11) as claimed in any one of the

preceding claims in which the thicknesses of at least two of the polymeric layers (14,15,16) are different.

8. A substrate (11) as claimed in any one of the preceding claims wherein the metallic layers (18,19) are only present in a limited region of the substrate.

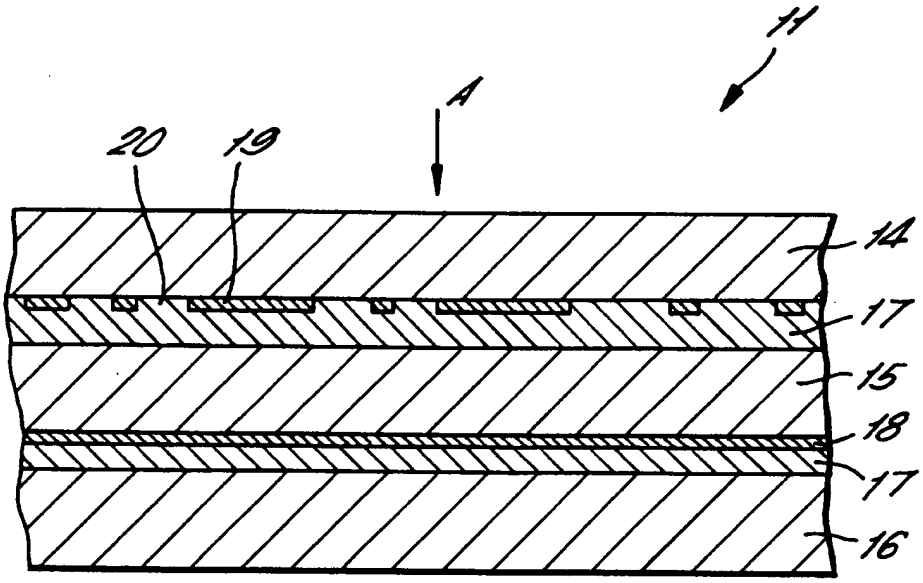
9. A security document produced from the substrate (11) as claimed in any one of the preceding claims.

10. A security document incorporating a limited region produced from a substrate (11) as claimed in any one of claims 1 to 8.

11. A security element produced from the substrate (11) as claimed in any one of claims 1 to 8.

12. A security document incorporating a security element as claimed in claim 11, which element is exposed at intervals in windows.

FIG. 1.



INTERNATIONAL SEARCH REPORT

Internat' al Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B32B27/06 B42D15/00 B42D15/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B32B B42D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 83 00659 A (COMMW SCIENT IND RES ORG ;AUSTRALIA RESERVE BANK (AU)) 3 March 1983 (1983-03-03) cited in the application page 8, line 1 -page 11, line 22; claims; figures	1,9,11
A	WO 97 01438 A (MOBIL OIL CORP) 16 January 1997 (1997-01-16) cited in the application page 2, line 7 - line 29; claims 1,7,12-20 page 4, line 2 - line 30	1,9,11, 12
A	US 5 618 630 A (BENOIT GORDON L ET AL) 8 April 1997 (1997-04-08) cited in the application column 5, line 48 - line 53; claims column 6, line 35 - line 61	1,9,11, 12

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[X] Further documents are listed in the continuation of box C.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 374 763 A (GAO GES AUTOMATION ORG) 27 June 1990 (1990-06-27) column 5, line 5 -column 6, line 34; claims; figures	1,4,9,11
A	FR 2 279 548 A (CIT ALCATEL) 20 February 1976 (1976-02-20) claims; example 3	1,9,11
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Information on patent family members

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